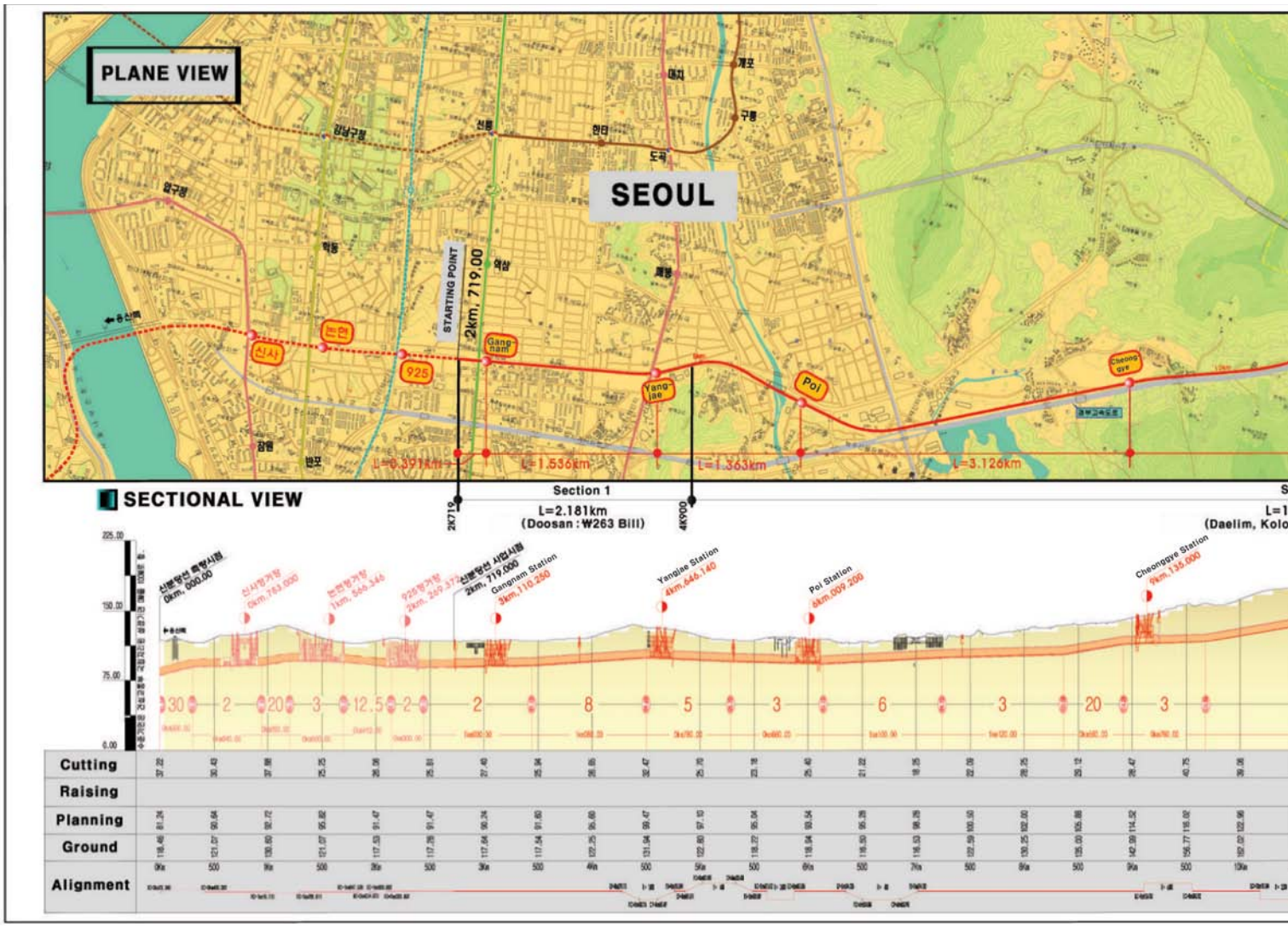
Korean Metro Shinbundang Project

The Pandrol VANGUARD system is gaining widespread recognition for its excellent performance in controlling ground vibration. The system is now being installed all over the world, and has recently been adopted by the Korean Metro Shinbundang Project.

	in	Phase I	Phase II	Total
Dual Track Construction	Km	20.721	18.491	39.212
Concrete Pour	m^2	21,993	21,192	43,185
Vanguard System	set	7,358	6,926	14,284

The Shinbundang project covers the construction and operation of a dual-track railway connecting Gangnam, Seoul and Bundang, in the south-east suburbs of the capital city. 'Bundang' is a new town that was built on the south-east outskirts of Seoul in the early 1990s, and 'shin' simply means 'new' in Korean, so combining the two gives the project its name, meaning 'New Bundang' line.

Bundang has become known as a popular residential area, giving easy access to the Seoul Gangnam district, the busiest business and

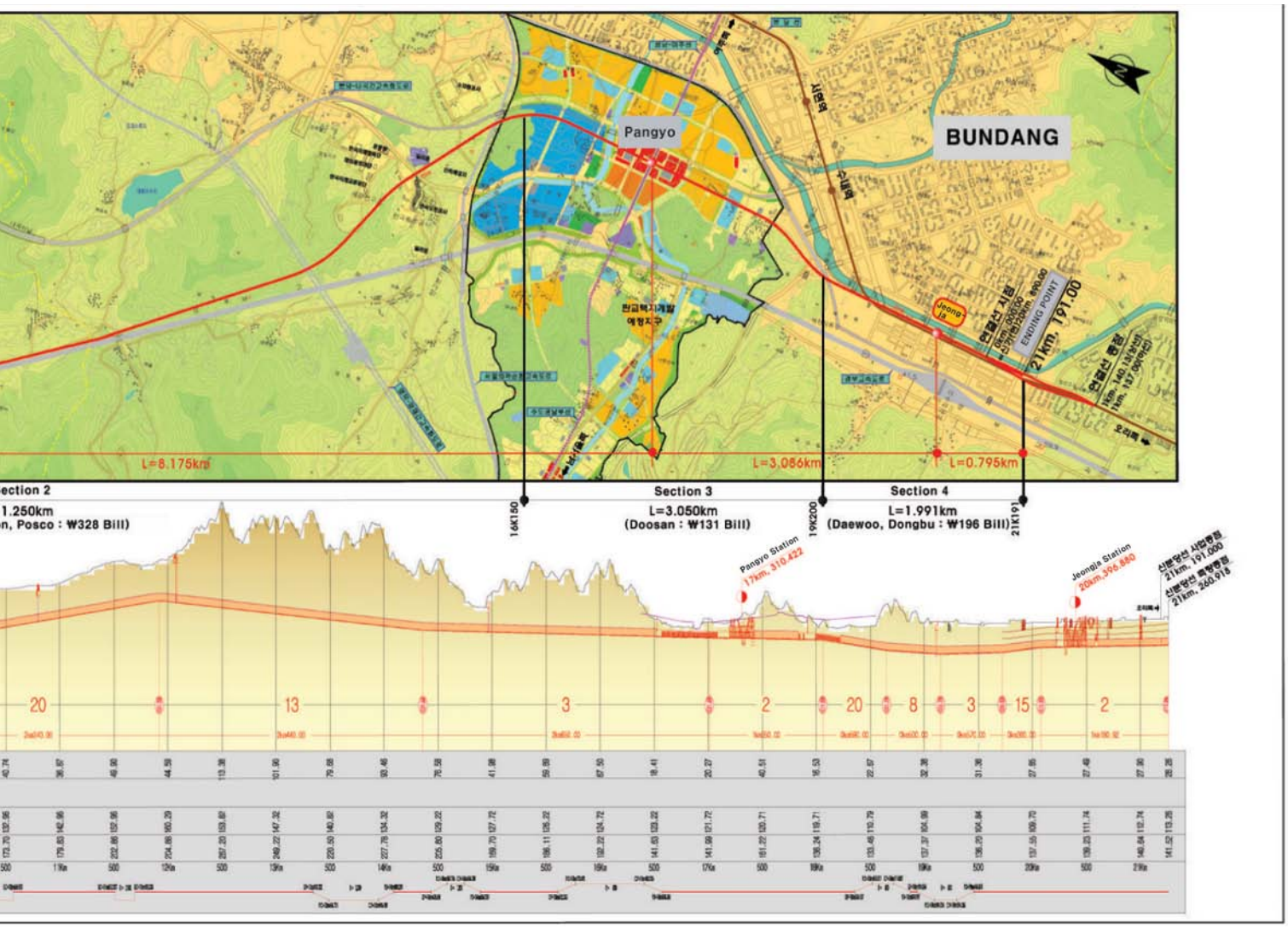


Map showing route, distance and depth of tunnel

commercial centre of the nation. The new town rapidly gained in popularity and it has been fully occupied since the start of the new Millennium. However, new residents continue to be drawn to the area, and the demand has not abated. It was decided by the government to build another new town, to be called 'Pangyo', immediately adjacent to Bundang. It was therefore necessary to provide an effective transport system to cover not only the expanding population of Bundang, but also for the new residents of Pangyo.

The Shinbundang Line is being constructed using the BTO (Build-Transfer-Operate) model, which means that ownership will revert to the nation at the completion, while the concessionaire Shinbundang Railroad Co., Ltd operates the system for 30 years. The Shinbundang Railroad Co., Ltd is a consortium of 7 companies, including Doosan Construction & Engineering Co., Ltd.

Track with VANGUARD fastenings prior to concrete slab pour



VANGUARD assemblies pre-assembled on the rail complete with anchor fastenings

The construction of the line commenced in July 2007 and is scheduled to be completed in September 2011. It is a rapid transit system with a maximum operating speed of 90km/h. There will be 6 stations between Gangnam and Jeongja. It will take 16 minutes to ride the total length of 18.5km, on driverless, fully automated 5-car trains. Trains will run 312 times a day at 8 minute intervals and at 5 minute intervals during rush-hours.

The Shinbundang track will be constructed with concrete slab throughout, including all turnout sections, so it was essential to have an effective vibration attenuation system.

The problem faced by the design team was that the existing track system specified would not meet the reduced noise and vibration requirements for the areas of track directly below new residential buildings. Excluding costly floating slab, the Pandrol VANGUARD system was the only system that could reduce noise and vibration to the required level of 55 dB and below in this residential area, over a length of approximately 2km and involving 14,284 baseplates.

Following the selection of the Pandrol VANGUARD system, a small party of engineers from KTRC and the Shinbundang project team visited the Pandrol Development Laboratory in Nottinghamshire in the UK, to approve the system and finalize the track build method. Pandrol VANGUARD installations on the Shinbundang line will consist of 14,284 units over 2 phases over the next 2 years.

The first installation of the Pandrol VANGUARD system was made on June 30th, 2009 near Pangyo station. The particular configuration that is being used on the Shinbundang line project is a standard 4-hole Vanguard baseplate for direct fixation on to a stage 2 fixed concrete slab, using bolts into cast-in inserts. The build method used on this project is a so-called top-down construction "plunge" method, described below and similar to that used to install Pandrol VANGUARD at St Pancras station in London. The baseplates are first pre-assembled on to lengths of continuously welded rail. These sections are lifted into position and set to line and level using the existing design of track-adjustment system jigs.

Concrete Slab being poured

Due to the location of the Pandrol VANGUARD track sections within the tunnel and the distance from the construction access point, the concrete contains a greater proportion of water than usual to allow it to be pumped to the required area. It was feared that the effect of the high water content could be that if the concrete were simply to be poured directly under the Pandrol VANGUARD baseplates, then moisture exuded from the concrete could form voids beneath the baseplates. Therefore, the "plunge" method has been adopted. The whole track is raised an additional fixed 5mm above the final poured concrete datum level. During the concrete pour stage, the final concrete level is obtained, and top surface then floated flat to the required surface finish. The concrete is monitored directly after the pour stage to assess the amount of water separating from the concrete top surface. Any surface water is removed prior to the complete track section being lowered by the 5mm initial offset into the still-wet concrete slab. In this way the required track height is achieved while removing trapped water and avoiding voids beneath the baseplates.

After the concrete had set for 28 days to obtain full hardness, the anchor bolts were fully torqued to the required 120Nm ± 20Nm (maximum limit 150Nm), and any final gauge adjustments made.

The project now foresees a second installation of the Pandrol VANGUARD system towards the end of 2009. With these further installations of VANGUARD, the residential areas of Pangyo new town will benefit from a high-performance system to control ground vibration and the resulting secondary noise. ■

VANGUARD assemblies are protected during the concrete pour to prevent ingress of concrete into the fastening

Track after concrete pour: making the final height adjustment